

NUMBER SYSTEMS - HEXADECIMAL

THE HEX SYSTEM

NUMBER SYSTEMS PART 2

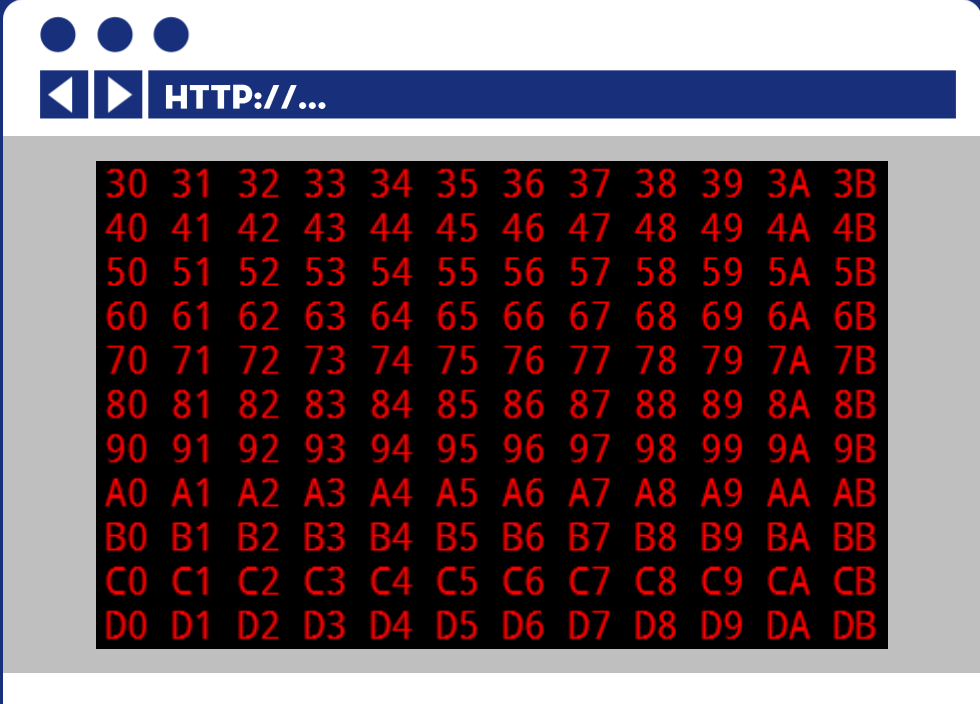
SIXTEEN DIFFERENT SYMBOLS

▀ WHERE BINARY USES TWO, AND DECIMAL USES TEN, THE HEX SYSTEM USES SIXTEEN DIFFERENT SYMBOLS TO COMPOSE IT'S NUMBERS

▀ 0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F
▀ INCREASING ORDER

▀ THIS MEANS THAT PLACE VALUES REPRESENT POWERS OF 16

- ▀ $16^0 = 1$
- ▀ $16^1 = 16$
- ▀ $16^2 = 256$
- ▀ $16^3 = 4096$
- ▀ $16^4 = 65536$
- ▀ ...



A browser window with a dark blue header bar containing navigation arrows and the text "HTTP://...". The main content area is a black rectangle with red text displaying a grid of hexadecimal numbers from 30 to DB, arranged in 16 rows and 16 columns.

30	31	32	33	34	35	36	37	38	39	3A	3B				
40	41	42	43	44	45	46	47	48	49	4A	4B				
50	51	52	53	54	55	56	57	58	59	5A	5B				
60	61	62	63	64	65	66	67	68	69	6A	6B				
70	71	72	73	74	75	76	77	78	79	7A	7B				
80	81	82	83	84	85	86	87	88	89	8A	8B				
90	91	92	93	94	95	96	97	98	99	9A	9B				
A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	AA	AB				
B0	B1	B2	B3	B4	B5	B6	B7	B8	B9	BA	BB				
C0	C1	C2	C3	C4	C5	C6	C7	C8	C9	CA	CB				
D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	DA	DB				

WHY BOTHER?

- **BINARY IS CUMBERSOME FOR PEOPLE**
- **COMMUNICATING BINARY NUMBERS BECOMES TEDIOUS - SO MANY BITS!**
- **REPRESENTING BINARY AS HEX IS A COMPROMISE BETWEEN ACCURATE COMPUTER DATA REPRESENTATIONS AND HUMAN CONVENIENCE**



HEX TO DECIMAL

- SIMILAR TO BINARY TO DECIMAL
- WRITE OUT THE NUMBER (HEX)
- WRITE THE POWERS OF 16 UNDER THE DIGITS
- MULTIPLY BY INDIVIDUAL DIGIT DECIMAL EQUIVALENT
- ADD EVERYTHING UP!

$1D_{16} = ?_{10}$

1 (1)	D (13)
$16^1 = 16$	$16^0 = 1$
$1 \times 16 = 16$	$13 \times 1 = 13$
$16 + 13 = 29$	

$1D_{16} = 29_{10}$

HEX TO DECIMAL

• ANOTHER EXAMPLE

$1B6_{16} = ?_{10}$

1	B (11)	6
$16^2 = 256$	$16^1 = 16$	$16^0 = 1$
$1 \times 256 = 256$	$11 \times 16 = 176$	$6 \times 1 = 6$
$256 + 176 + 6 = 438$		

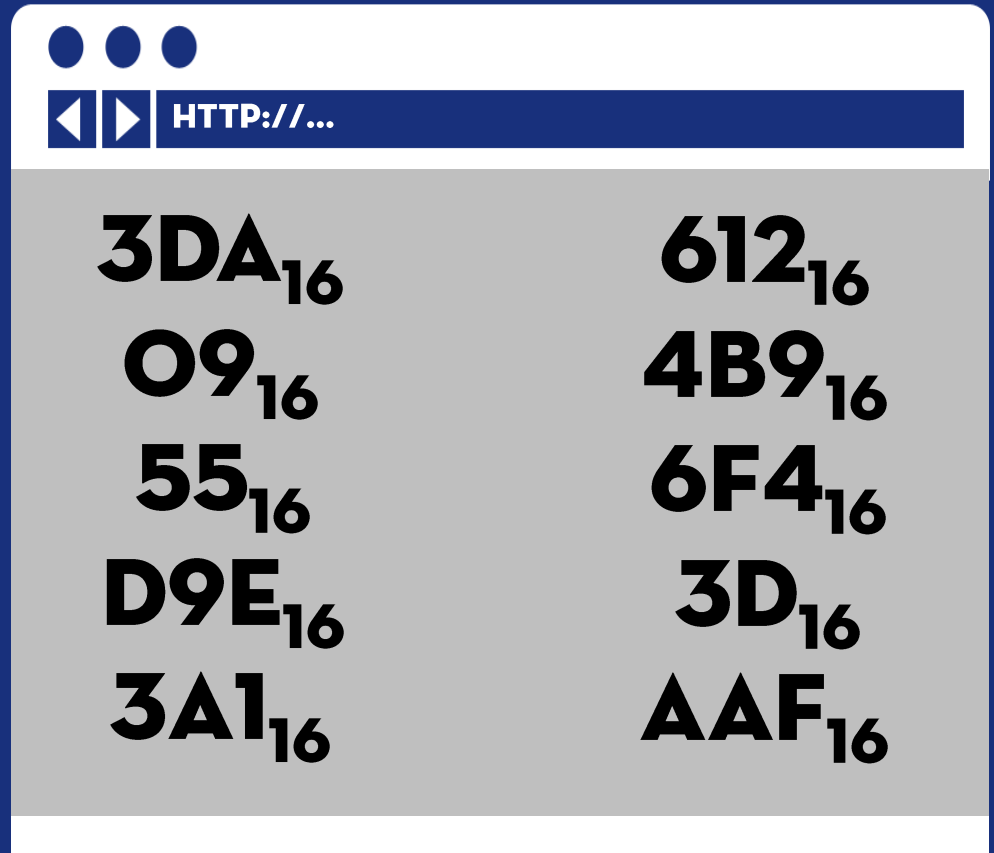
$1B6_{16} = 438_{10}$

CONVERTING H-D

NUMBER SYSTEMS PART 2

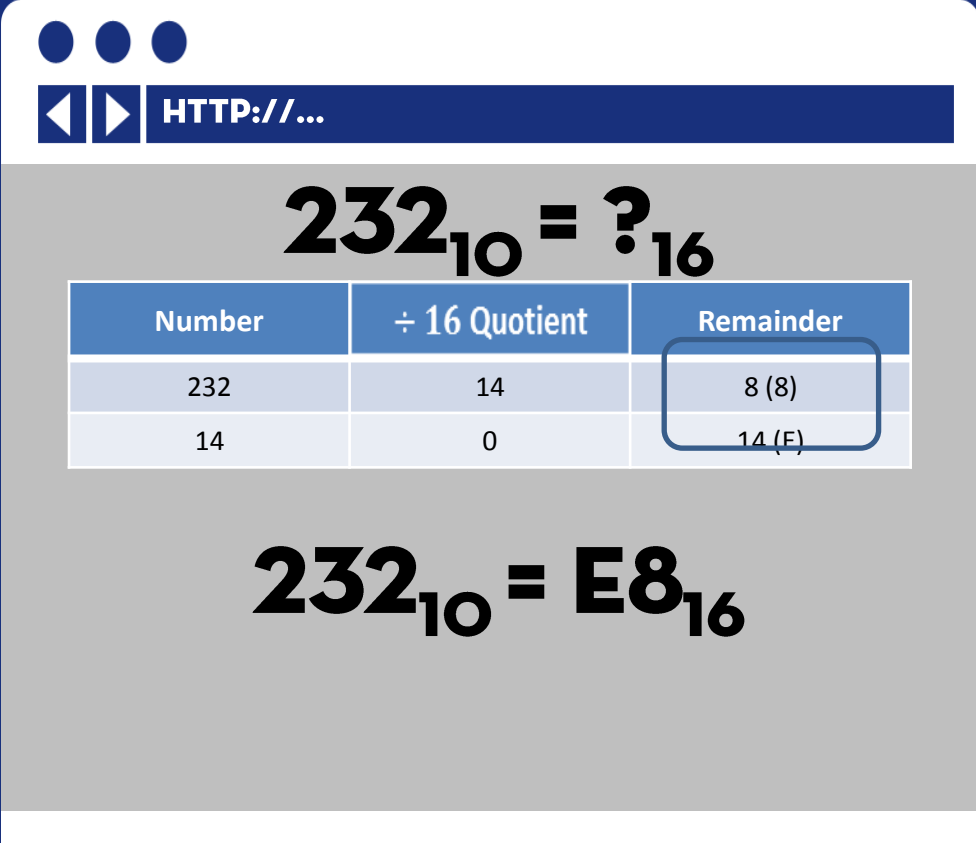
PRACTICE

•TRY THESE EXAMPLES TO PRACTICE
HEX TO DECIMAL CONVERSIONS



DECIMAL TO HEX

- SIMILAR TO BINARY - REPEATED DIVISION
- THIS TIME DIVIDE BY 16
- RECORD QUOTIENT AND REMAINDER
- CONVERT INDIVIDUAL DIGITS AT END
- READ BOTTOM-TO-TOP



A browser window with a white title bar and three blue window control buttons. The address bar shows "HTTP://...". The main content area has a light gray background. At the top, the equation $232_{10} = ?_{16}$ is displayed in large black font. Below it is a table with three columns: "Number", "÷ 16 Quotient", and "Remainder". The first row shows 232, 14, and 8 (8). The second row shows 14, 0, and 14 (E). The "Remainder" column is highlighted with a blue border. Below the table, the equation $232_{10} = E8_{16}$ is displayed in large black font.

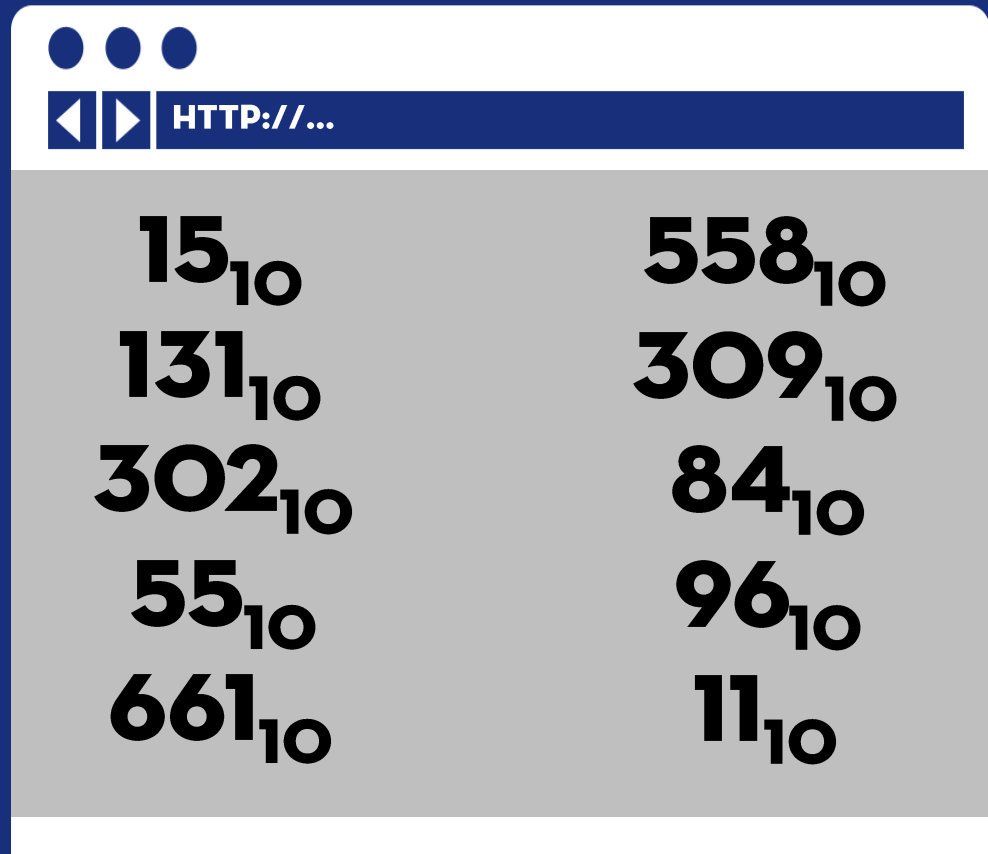
Number	÷ 16 Quotient	Remainder
232	14	8 (8)
14	0	14 (E)

CONVERTING D-H

NUMBER SYSTEMS PART 2

PRACTICE

• TRY THESE EXAMPLES TO PRACTICE
DECIMAL TO HEX CONVERSIONS



CONVERTING B-H

NUMBER SYSTEMS PART 2

BINARY TO HEX

•EACH HEX DIGIT CORRESPONDS TO 4 BINARY DIGITS

•SEPARATE THE BINARY NUMBER INTO GROUPS OF 4 DIGITS, STARTING FROM THE RIGHT

•REPLACE EACH 'NIBBLE' (4 BITS) WITH IT'S HEX EQUIVALENT

•DONE!

A browser window with a dark blue header and a light gray body. The address bar shows "HTTP://...". The main content area displays the conversion of the binary number 10111 to the hexadecimal number 17. The conversion is shown in a vertical, step-by-step manner:

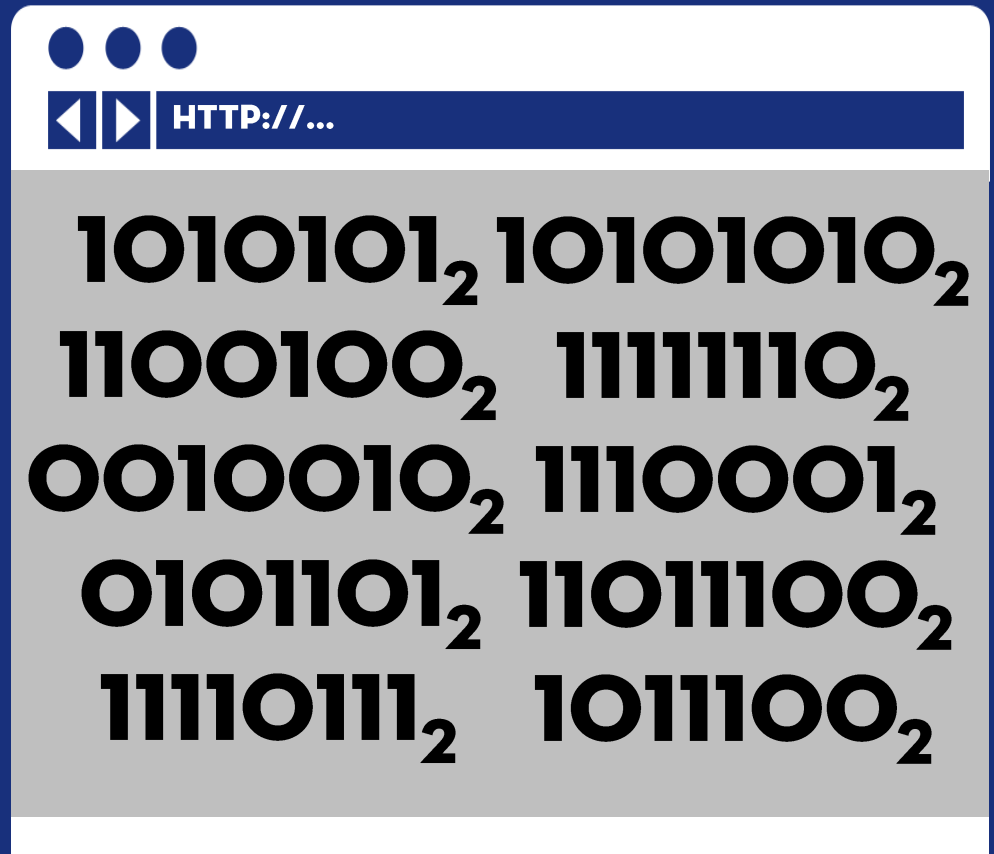
$$10111_2 = ?_{16}$$
$$\begin{array}{r} 10111 \\ = \\ 1 \quad 0111 \\ = \\ 1 \quad 7 \\ = \\ 17_{16} \end{array}$$
$$10111_2 = 17_{16}$$

CONVERTING B-H

NUMBER SYSTEMS PART 2

PRACTICE

• TRY THESE EXAMPLES TO PRACTICE
BINARY TO HEX CONVERSIONS



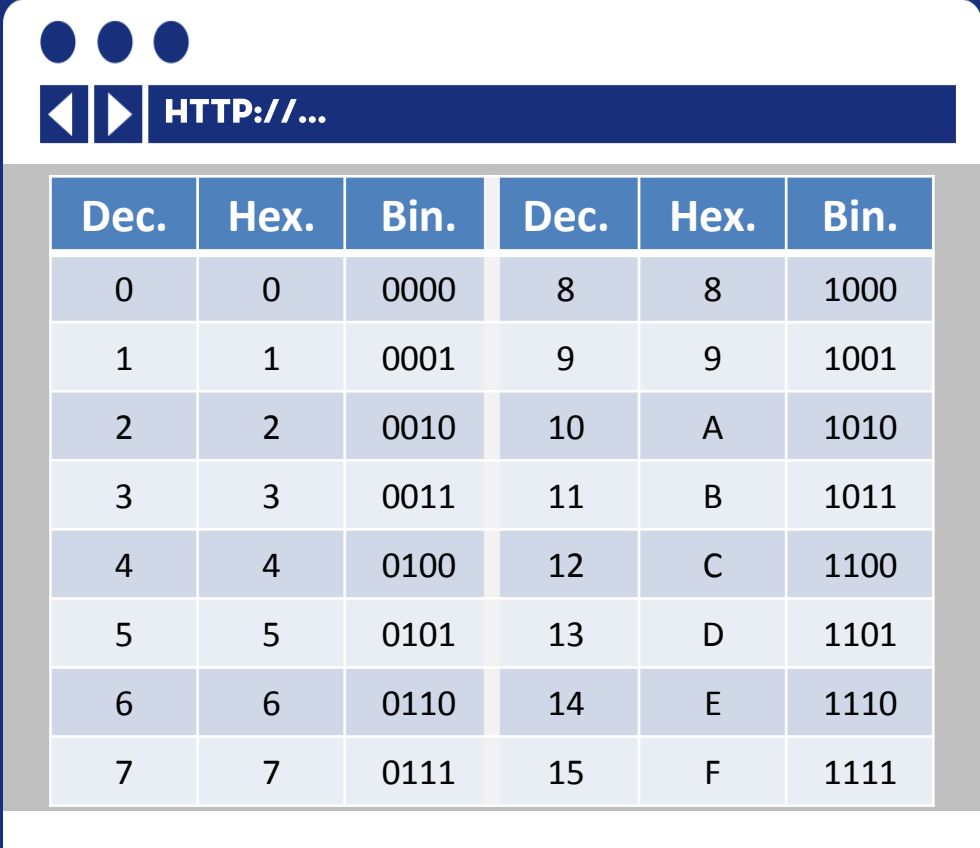
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A TOOL TO REMEMBER!

NUMBER SYSTEMS PART 2

A SIMPLE TABLE CAN HELP YOU...

IF YOU CAN REPRODUCE THIS TABLE, IT WILL HELP YOU A LOT ON THE TEST



A browser window mockup with a dark blue header bar containing navigation arrows and the text "HTTP://...". Below the header is a table with 12 rows and 6 columns. The columns are labeled "Dec.", "Hex.", "Bin.", "Dec.", "Hex.", and "Bin.". The table contains the following data:

Dec.	Hex.	Bin.	Dec.	Hex.	Bin.
0	0	0000	8	8	1000
1	1	0001	9	9	1001
2	2	0010	10	A	1010
3	3	0011	11	B	1011
4	4	0100	12	C	1100
5	5	0101	13	D	1101
6	6	0110	14	E	1110
7	7	0111	15	F	1111

THE END!